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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/919,325 | 07/31/2001 | Christopher P. Brophy | SP00-226 | 3727 |

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EXAMINER

O NEILL, GARY W

ART UNIT PAPER NUMBER

2873

DATE MAILED: 01/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | | |
|------------------------------|------------------------|--|---------------------|--|
| Office Action Summary | Application No. | | Applicant(s) | |
| | 09/919,325 | | BROPHY ET AL. | |
| | Examiner | | Art Unit | |
| | Gary O'Neill | | 2873 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____. | 6) <input checked="" type="checkbox"/> Other: Detailed Action. |

DETAILED ACTION

Priority

1. Acknowledgement is made of applicant's claim for domestic priority under 35 U.S.C. 119(e) based on Provisional application number 60221940 filed 7/31/00.

Specification

2. The disclosure is objected to because of the following informalities: on page 4, in paragraphs 0027, 0029, 0030, and 0031, the ending punctuation marks should be changed from periods to semicolons.

Appropriate correction is required.

3. Claim 16 is objected to because of the following informalities: The word "mirror" should be changed to "mirrors". Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this

Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Shaw et al. (5719073).

Art Unit: 2873

Shaw et al. discloses, as in claim 1, a moveable micromirror (fig.2) comprising: a supporting structure (50); a flexible post (52) extending from the supporting structure; and a table (62) extending radially from the end of the post along a plane generally perpendicular to the post, the table having a reflective surface (col.4, lines 60-67, moveable mirrors) facing away from the supporting structure, wherein the post is so constructed so as to be sufficiently flexible (col.17, lines 60-67) to allow the reflective surface to be selectively moveable and positionable, with at least two degrees of freedom (col.4, lines 12-22: X,Y,& Z axes), when urged by a suitable actuating force.

Shaw et al. discloses, as in claim 2, the moveable micromirror wherein the flexible post extends from the supporting structure from within a trench in the supporting structure such that more than one half of the length of the post is within the trench (fig.2 & col.11, lines 62-67).

Shaw et al. discloses, as in claim 3, the movable micromirror wherein at least three-quarters of the length of the post is within the trench (fig.2 & col.11, lines 62-67).

Shaw et al. discloses, as in claim 4, the moveable micromirror wherein the supporting structure and the post are formed of a single crystal of silicon (50).

Shaw et al. discloses, as in claim 5, the moveable micromirror further comprising conductive pads (60,64) positioned on a surface of the supporting structure facing the table, and wherein the table includes a conductive material (col.13, lines 49-67, metallization).

Shaw et al. discloses, as in claim 6, the moveable micromirror wherein the average distance from the surfaces of the conductive pads to the surface of the table facing the conductive pads is less than the length of the post (fig.2 & col.11, lines 62-67).

Shaw et al. discloses, as in claim 7, the moveable micromirror wherein the average distance from the surfaces of the conductive pads to the surface of the table facing the conductive pads is less than one-half the length of the post (fig.2 & col.11, lines 62-67).

Shaw et al. discloses, as in claim 8, the moveable micromirror wherein the average distance from the surfaces of the conductive pads to the surface of the table facing the conductive pads is less than one-third the length of the post (fig.2 & col.11, lines 62-67).

Shaw et al. discloses, as in claim 9, the moveable micromirror further comprising an electrostatic actuator structured and arranged so as to be able to selectively position the reflective surface (col.3, lines 41-54. It is inherent that an electrostatic actuator is included).

Shaw et al. discloses, as in claim 10, the moveable micromirror further comprising an electromagnetic actuator structured and arranged so as to be able to selectively position the reflective surface (col.3, lines 41-54. It is inherent that an electromagnetic actuator is included).

Shaw et al. discloses, as in claim 11, the moveable micromirror further comprising a piezoelectric actuator structured and arranged so as to be able to

Art Unit: 2873

selectively position the reflective surface (col.3, lines 41-54. It is inherent that an piezoelectric actuator is included).

Shaw et al. discloses, as in claim 12, the moveable micromirror further comprising a thermal actuator structured and arranged so as to be able to selectively position the reflective surface (col.3, lines 41-54. It is inherent that an thermal actuator is included).

Shaw et al. discloses, as in claim 13, an array of moveable micromirrors comprising two or more micromirrors (col.4, lines 60-67 & col.5, lines 1-42).

Shaw et al. discloses, as in claim 14, a moveable micromirror (fig.2) for selectively directing optical beams, the micromirror comprising: a substrate (50) formed of a first single crystal of silicon; a post (52) extending from within a moat (54) in a surface of the substrate, the post being formed of the single crystal of silicon; a table (62) fixed to and supported by the post and having a reflective surface (col.4, lines 60-67, moveable mirrors) facing away from the surface of the substrate and a second surface facing the surface of the substrate, the distance from the surface of the substrate to the second surface of the table being less than the length of the post (fig.2); and an actuator (col.3, lines 17-33) positioned on the surface of the substrate adjacent the second surface of the table and structured so as to be able to selectively position the table by applying an actuating force to the table wherein the post is sufficiently flexible (col.17, lines 60-67) to allow the reflective surface to be selectively moveable and positionable by the actuator.

Art Unit: 2873

Shaw et al. discloses, as in claim 15, the moveable mirror wherein the actuator is an electrostatic actuator (col.3, lines 41-54. It is inherent that an electrostatic actuator is included).

Shaw et al. discloses, as in claim 16, an array of micromirrors comprising at least two moveable mirrors (col.4, lines 60-67 & col.5, lines 1-42).

Shaw et al. discloses, as in claim 17, a method of making an array of moveable micromirrors (figs.1A-1L), the method including: deep etching (col.9, lines 60-67 & col.10, lines 1-62) a silicon substrate (10) so as to form posts (26) surrounded by trenches (22); etching back the surface of the substrate around the posts so as to allow the posts to protrude beyond the surface of the substrate (col.11, lines 39-53); and affixing a mirror (col.4, lines 60-67) to the top of a plurality of the posts.

Shaw et al. discloses, as in claim 18, the method wherein the step of affixing a mirror to the top of a plurality of the posts includes: bonding a wafer (150) to the tops of the plurality of the posts; depositing one or more reflective layers on the surface of the wafer opposite the posts; and deep-etching the wafer to separate the wafer into individual mirrors affixed to the top of each post of the plurality of the posts (col.17, lines 60-67 & col.18, lines 1-67).

Shaw et al. discloses, as in claim 19, the method wherein the step of affixing a mirror to the top of a plurality of the posts further includes, before the step of bonding a wafer to the tops of the plurality of the posts, the step of forming a removable layer (110) on the substrate, and wherein the step of bonding a wafer to the tops of the plurality of the posts includes positioning the

Art Unit: 2873

wafer in contact with the tops of the posts and in contact with the removeable layer (Table IV & col.18, lines 1-67).

Shaw et al. discloses, as in claim 20, the method wherein the removeable layer is a layer of photoresist (Table IV, resist).

Shaw et al. discloses, as in claim 21, the method wherein the step of bonding a wafer to the tops of the plurality of the posts includes etching notches in the wafer and aligning the notches with the plurality of the posts such that the plurality of the posts are positioned within the notches and are bonded to the wafer in the notches (col. 5, lines 4-15).

Shaw et al. discloses, as in claim 22, the method wherein the step of deep etching the wafer to separate the wafer into individual mirrors includes deep reactive ion etching (col.6, lines 7-14, Tables I & IV, RIE).

Shaw et al. discloses, as in claim 23, the method wherein the step of deep etching the silicon substrate includes deep reactive ion etching (Tables I & IV, RIE).

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following references are cited for disclosing micromirror structures having flexible posts in trenches and methods of forming the same from single crystal silicon: Hornbeck (4710732); Um (5159225); Lim (5469302); Yoon (5506720); Ji et al. (5696618); Shaw et al. (5846849); Swart et al. (6025951); and Reuter et al. (6059250).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gary O'Neill whose telephone number is 703-306-4828. The examiner can normally be reached on Monday - Thursday, 6:30AM - 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Y Epps can be reached on 703-308-4883. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7725 for regular communications and 703-308-7725 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Gary O'Neill
Examiner
Art Unit 2873



GO
December 30, 2002



Hung Xuan Dung
Primary Examiner